Dynamite—The New Aladdin's Lamp

By W. R. Ellis

WHAT HO! A war broke loose in the Grand Canyon—man against nature. In a few hours thousands of tons of rock were blown from its long undisturbed place of rest. Not so many years ago a similar war was staged in the Isthmus of Panama where a trench was excavated from the Atlantic to the Pacific large enough for ships to enter. Bite by bite the side of a mountain of red-brown iron ore comes into man's possession. Coal is wrest from its underground hiding. The war of man against nature is too strong for weakly man. He must employ some demon of his master mind to win the combats. When man puts this demon to work for him nature must either give up her treasures or make way for man's engineering structures. This demon is explosives—dynamites. The three type most comomnly used in this country are gelatin, ammonium nitrate and straight nitroglycerin dynamites.

Subways, skyscrapers, railroads, highways, dams, bridges, tunnels and in fact almost every structure being built today requires the use of explosives in its construction. Indeed some of the engineering feats being performed today such as the magnificent Boulder Dam would be impossible if it were not for dynamite.

Dynamite is one of the greatest known instruments of progress, for without it our present day progress would be halted. It has been said that iron, copper and steam comprise the three most important elements of our success. These elements were known many years ago, but not until the fourth great element, dynamite, was invented did our industry boom. Without high explosives we were unable to obtain enough iron and copper ore to develop our steam engine. The influence of this agent can be traced and connected to the success and development of every industry. So it is obvious to us that high explosives are a great masterpiece of chemistry and the greatest aid to man ever developed in overcoming nature.

Let us consider some of the influences of explosives on the mining industry. In the U. S. 61 thousand ounces of silver were produced in 1860, whereas in 1870 after the introduction of dynamite 10 million ounces of silver were extracted from the earth,

In 1927 at Crown Mines, Johannesburg, South Africa, 3,603,100 lbs. of gelignite containing 1,809,176 lbs. of nitroglycerin were used. Before dynamite was produced in 1869 as a mining agent approximately 72 tons of copper ore had been mined, whereas 18 million tons were produced in 1920. These astounding figures reveal to us the important role dynamite has played in the development of our industry. Not only in a few places is it being put to valuable use but in all parts of the world.

When discussing dynamite, a necessity of life and industry, we are primarily interested in its history, origin, chemistry, manufacture and value. In the previous discussion I have only referred to and slightly touched upon a few of the numerous values of explosives, but I believe them to be indubitable. A discussion concerning the procedures and methods of applying the various types of dynamites could merely be enumerated in an article of this length. The manufacture and chemistry of explosives would be very interesting to some of us, but I think by far the most interesting step in the development of any remarkable product is that of its early history and origin. It is this development that I now wish to discuss.

The first record we have of the discovery of an explosive is found in the writings of Roger Bacon. It was back in the year of 1250 that Roger Bacon found that saltpetre, charcoal and sulphur when properly mixed would explode. This mixture known as black blasting powder is now refined but remains basically the same. Another name commonly employed for this mixture is black gunpowder. I found an interesting account of Bacon's work with gunpowder in the November 3, 1932 issue of The Chemistry Leaflet which was taken from a weekly journal edited by Charles Dickens under the name "Household Words." The article concerning Bacon's work appeared in this journal in May, 1850. I will quote the following from Dickens:

"There are few whose occult fame has stood higher than that of Roger Bacon. We shall give the words in which he speaks of the properties of gunpowder. 'Noyses,' he says, 'may be made in the aire like thunders, yea, with greater horror than those that come of nature for a little matter fitted to the quantity of a thimble, maketh a horrible noise and wonderful lightning. And this is done after sundry fashions where-by any critic or armies may be destroyed.' A more accurate description of the explosion of gunpowder could scarcely be given and it is not to be supposed that Bacon simply confined himself to the theory of his art, when he knew so well the consequence arising from a practical application of it."

Bacon was assisted in his laboratory by a youthful and zealous Norman student. As far as we know his name was Hubert de Dreux. Hubert was a great favorite of the philosopher. Many of Bacon's secrets were revealed to this youth. Though never does such a man reveal the full amount of his knowledge to an understudy. Bacon experimented with the combining of sulphur, charcoal and saltpeter in a cell which stood apart from his general laboratory. Not even Hubert had access to this cell. The youth was bewildered by the strange noises, flashes of

light and a singular odor which occassionally came from the Friar's cell. He was very eager to discover the secret. When something is being secretly carried on around us it is human nature to pry into its meaning. Many days passed before an opportune moment presented itself for Hubert to investigate the secret.

At this time the most useful practice of conventional life was the art of healing. There were always practitioners among the monks more or less skillful in this art. Roger Bacon was the most eminent in all Oxford.

In 1282, near the end of November, one day about noon a messenger on horseback arrived at the gate of the convent. He brought news from Abington that Watler de Losely, the sheriff of Berkshire, had met with a serious acident that morning. He had received a wound from a lance. The messenger stated that they were anxious for the assistance of the skillful Friar, Roger Bacon. Bacon was immediately sought and speedily made his appearance.

He took his case of instruments with bandages and salves and was on his way to Abington. Hubert, after all was again quiet around the monastery, resumed his work which his master had assigned to him.

Suddenly he raised his head from his work. A gleam of joy and fear mingled in his eyes. It was the first time since Bacon had begun his strange work in the isolated cell that Hubert had been left alone. He crept to the hall of the laboratory and reassured by the stillness he stole to the door of the cell. At a glance he saw that the key was not in the door. He knelt to peep through the key hole, but when he pressed against the door it opened. Hubert quickly arose to his feet and entered the cell. There was the expected crucibles of material evidencing his master's work. A parchment volume on the table immediately attracted his attention and he eagerly read the lines on the last page.

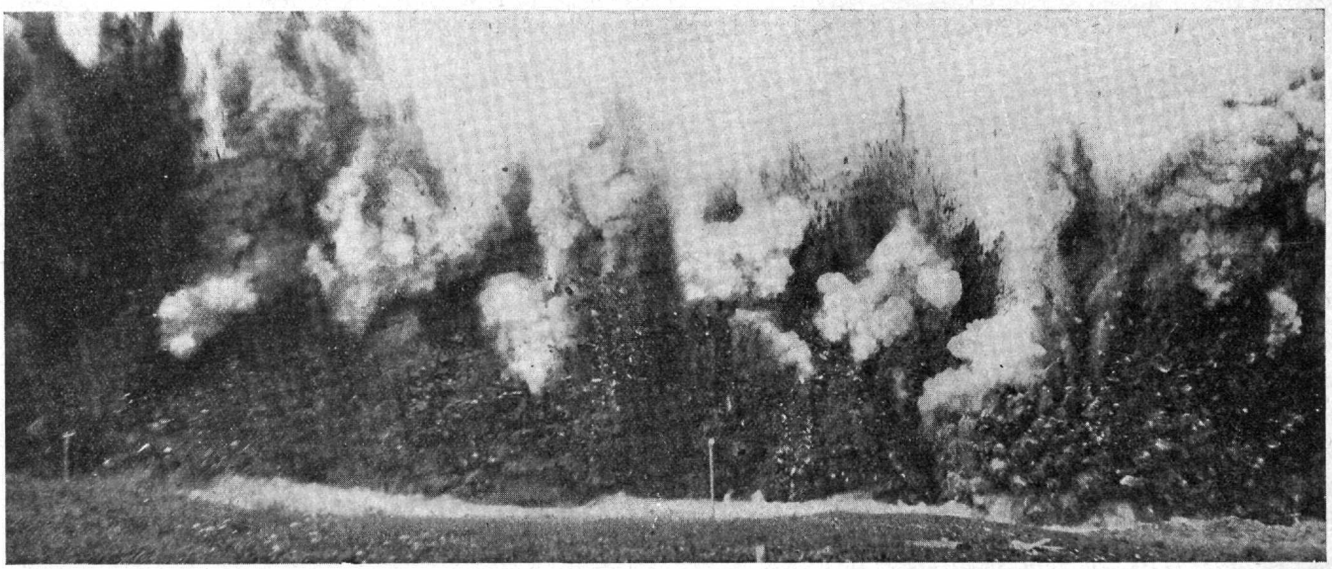
" 'Videas tamen utrum loquar in alnigmate vel secumdum veritatem.' Which we translate, 'he that would see these things shall have the key that openeth and no man shutteth, and when he shall shut, no man is able to open again.' "

This was not the secret! Hubert hurriedly turned back to the preceding page and read the passage which spoke of artificial thunder and lightning. Beneath was the receipe for its composition which explained the meaning of the strange noises and flashes of light. There were the materials and the receipt. Why could he not perform the experiment? The temptation was too great for the young scientist.

" 'Here are all the necessary ingredients,' he exclaimed. 'This yellowish powder, the well known sulphur; this bitter, glistening substance, the salt of rock, the salis petrae; and this black calcination, the third agent—but the proportions are given, and here stands the glass cucurbit in which they should be mingled. It is of the form my master mostly uses—round, with a small neck and a narrow mouth, to be luted closely, without doubt. He has often told me that the sole regenerating power of the universe is heat; yonder furnace would supply it, and then Hubert de Dreaux is his master's equal.' "

As the day was drawing to a close Roger Bacon again turned toward Oxford. An hour's ride brought him near to the walls of the city, where he drew rein and sauntered along in the cool of the evening musing over his latest discovery. There was a flash of light, roar of thunder, a shrill shriek and then a gush of flames burst forth. There had not been much time to think but Bacon understood the nature of the fire because on the wind there came a sulphurous odor. The fire had caught the fulminating powder. The cold sweat ran down the Friar's face. He wondered what the dreadful cry could have meant; it couldn't be Hubert for he was in the farther extremity of the building. The Friar spurred his horse and rode on to the scene.

Many people had gathered. Above the roar of the fire and the outcries of the excited monks was heard Bacon's plea for them to extinguish the flames. Everyone turned



The magnitude of this charge can be noted by the comparative height of the telephone poles

upon the Friar and immediately associated him with the evil.

" 'Seize the accursed magician,' they shouted; 'he has made a fiery compact with the demon! Already one victim is sacrificed, our time will come next. See, here are the mangled limbs of his pupil, Hubert de Dreaux! The fiend has claimed his reward, and borne away his soul. Seize on the wicked sorcerer and take him to a dungeon.' "

So Roger Bacon was thrown into prison where he spent most of his time thinking of the value of his discovery to man.

In 1845, Schonbein at Basel in Switzerland produced scheissbaumwohle, or guncotton. This was produced by heating cotton with mixture of nitric acid and sulfuric acid. Many scientists over the country were interested in this new explosive. They performed numerous experiments with it; many were accompanied by serious accidents.

It was the young Italian, Ascanio Sobrero, who in 1846 first produced the high explosive, nitroglycerin. However, he was unable to produce it in a form which would be practical. It would not explode when he applied his ideas of detonating agents. It did explode, however, at times when least expected.

The engineering industry first made use of dynamite 68 years ago. It was Alfred Nobel who took nitroglycerin and after years of work with it finally produced what is known to us as dynamite. This was the first high explosive introduced that could be handled and used with reasonable safety. Realizing that nitroglycerin was very dangerous in its liquid form Nobel seized on the idea of absorbing the liquid in a mixture of powdered charcoal and gravel.

Much to Noble's surprise it was as hard to explode this mixture as it was to keep the liquid nitroglycerin from exploding. After the bore hole was charged with the dynamite and was all ready for the blast, Noble tried exploding gunpowder in the hole. This method of detonating the charge proved to be a failure.

He didn't become discouraged with his first invention after trying many ways of exploding it. After hard and steady work he finally tried gun caps charged with fulminate of mercury. This was the right road to his second great discovery and marked the first successful method of detonating high explosives.

Nobel's work was accompanied by many discouraging tragedies. A ship on its way to China was blown up by some of his nitroglycerin which was on board, and many similar disasters which cost many lives. These reports distressed him. While at his father's home in Stockholm working with nitroglycerin, an explosion occurred which killed five people including his younger brother, Emil. The result of this tragedy in Stockholm caused a law to be passed forbidding the manufacture of nitroglycerin in that city. Another brother was killed by an explosion in a factory at which he was working.

Alfred Nobel was a man of iron nerves. He worked with one purpose in mind and that he achieved. Every difficulty in his path was conquered. Knowing very little of chemistry he had to learn by experience—experience which was dangerous. He tamed this energetic monster, nitroglycerin, and made it serve man. Nobel set his teeth and moved forward with his task until he gave to us the ideal explosive and detonating agent. The world owes to him an everlasting debt of gratitude.
